Investigation of Superlattice Surface Characteristics

Completed Technology Project (2016 - 2020)

Project Introduction

This research will remove the major obstacle to realizing the full potential of infrared (IR) photodetectors using strained-layer superlattice (SLS) absorbers. Modeling of the SLS surfaces will be performed by the simultaneous solution of the Poisson and Schroedinger equations. This will yield the surface characteristics and conductivity types of selected SLS structures. Growth of SLS structures will be performed by molecular beam epitaxy. Crystal quality will be assessed with x-ray diffraction, photoluminescence, and atomic force microscopy. Interface quality will be assessed with transmission electron microscopy. Processing of complete IR photodetectors with SLS absorber regions will be performed using standard photolithography techniques. Device performance will be assessed with temperature-dependent current-voltage characteristics, surface conductivity measurements, and calibrated photocurrent response measurements. This research addresses one of the requirements of TABS element 8.1.1, that of large focal-plane array detectors with low noise. It addresses this requirement by investigating the surface characteristics of SLS structures in order to design a detector that correctly suppresses surface leakage currents. By combining the unipolar barrier with an SLS absorber, an IR detector can be created with high QE, suppressed band-to-band tunneling, reduced Auger generation, and an arbitrarily long cutoff wavelength.

Anticipated Benefits

By combining the unipolar barrier with an SLS absorber, an IR detector can be created with high QE, suppressed band-to-band tunneling, reduced Auger generation, and an arbitrarily long cutoff wavelength.

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Rochester

Responsible Program:

Space Technology Research Grants

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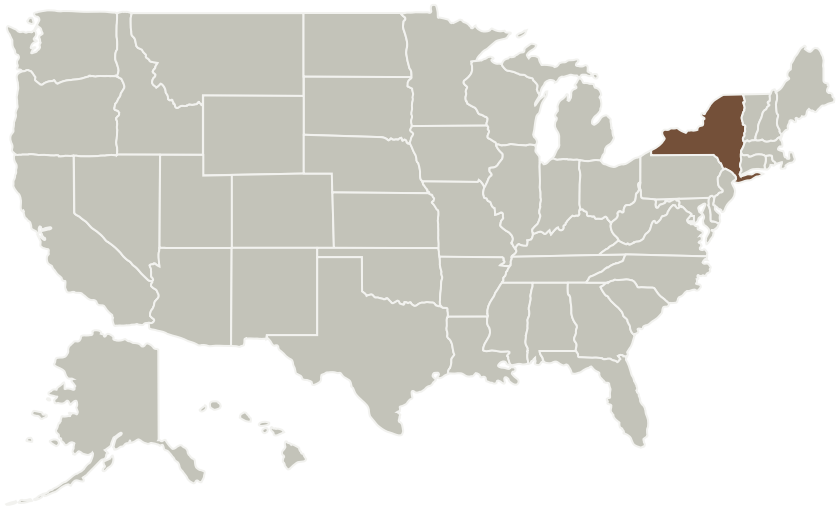
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Rochester	Lead Organization	Academia	Rochester, New York

Primary U.S. Work Locations
New York

Project Management

Program Director:
Claudia M Meyer

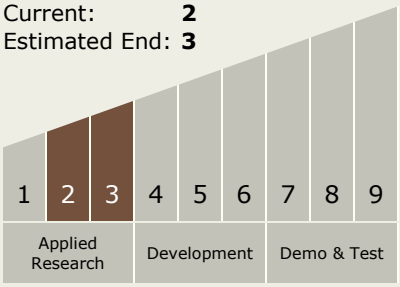
Program Manager:
Hung D Nguyen

Principal Investigator:
Gary Wicks

Co-Investigator:
Brendan Marozas

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Foundational Knowledge